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1922
no. 9
Engineering

M. WILSON. President | W. A. BOOTH Secretary | P. P. REYNOLDS Treasurer

OFFICIAL PROCEEDINGS
Meeting of December, 1922.

Volume XXI.
No. 9.

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INCORPORATED OCTOBER 1913

Canadian Railway Club

MONTREAL

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Contents

Report of December Meeting

and

Paper and Discussion on

"Present Day Tendencies In Car Construction"

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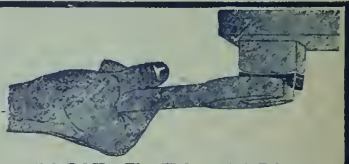

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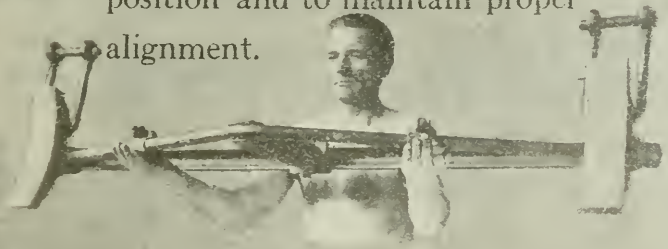

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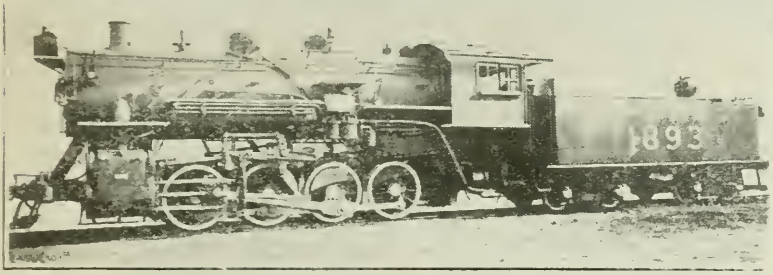

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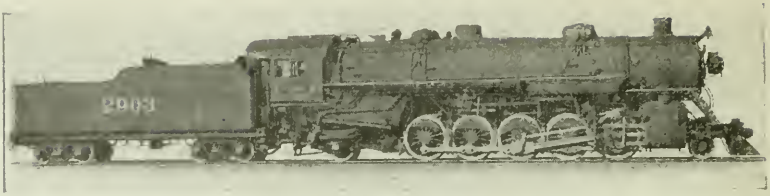

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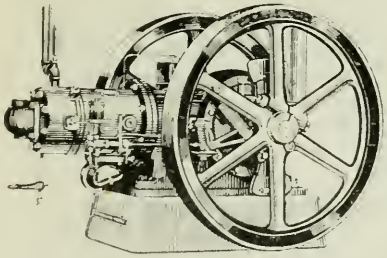

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W. A. BOOTH, Secretary, 53 Rushbrooke Street, Montreal.

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PROCEEDINGS OF THE CANADIAN RAILWAY CLUB

Windsor Hotel, Montreal,
December 12th,, 1922.

Chairman: (Mr. G. M. Wilson)

I will call the meeting to order, gentlemen.

The first item of business is to sign the attendance cards for record purposes.

MEMBERS PRESENT

Wilson, G. M.
Arnold, D. R.
Barrett, C. W.
Barrow, W.L.
Bartell, H. R.
Beahan, J. P.
Beaubien, D.
Bell, V.
Benger, F.
Bergen, F.
Birkett, L. H.
Boughton, L.
Boyd, G.
Brandon. J. D.
Brown, L.
Buckle, W. A.
Burns, J.
Cameron H. D.
Campbell, M. M.
Campfield, R. H.
Carmichall, C.
Carter, J. W.
Chian, E. T. Y.
Chown, T. C.
Coleman, J. W.
Coleman, M. T.
Collins, R.
Cooper, F. W.
Corcoran, J. C.
Crawford. R.
Crockett, W. B.
Daniels, E. C.
Dohm, J. F.
Dow, A. W.
Eakins, J. M.
East, G. A. (Jr.)
East, M. G.
Faughman, B.
Ferguson, J. P.
Fierro, H. M.
Firth, O. M.
Foley, E. L.
Foley, G. H.
George, L. B.
Graves, W. M.
Guest, A.
Gulick, H.
Hamaker, R. A.
Hanson, L. J.
Harragin, H. C.
Harvey, R. H.
Hendry, J.
Holland, F. E.
Holland, M.
Holland, S. C.
Horn, B. T.
Inns, G. A.
Jackson, J. R.
Jenner, W. C.
Kelly, E. J.
Kinnear, D. M.
Krauser, W. G.
Lecavalier, A.
Lowe, W. S.
Macnab. E. S. M.
Martin, C.
Matheson, A. G.
Miller, O. J.
Munro, J. D.
Mynard, T.
McEachran, J. A.
McEwan, W. H.
Naylor, H. R.
Neale, G.
Needham, R. J.
O'Connor, D. D.
Ogden, J.
Parker, W.
Paxton, J.D.
Pepper, A. H.
Peverley, R. D.
Phillips, F.
Pierpoint, F. H.
Playfair, J.
Powell, J.
Primeau, J. L.
Prowse, W.
Pugh, G. W.
Rehfuss, O. C.
Richardson,

Robertson, F.
Robinson, E. A.
Rosevear, W. H.
Ross, J. D.
Ross, N. E.
Saddler, E.
Seccombe, A. G.
Serchuck, H. W.
Seton, B. W.
Shaw, R. O.
Shortley, B. F.
Simpson, J. A.
Sleigh, T.
Smith, L. G.
Spry, S. H.
Starkey, J. B.
Stewart, W. H.
Strubbe, S. A. (Capt.)
Stuart, H. B.
Symmes, H. H.
Taylor, J.
Taylor, S. G.
Thorburn, C. D.
Thorp, H. W.
Tinkler, J. E.
Tompkins, G. A.
Towne, A. C.
Van de Wall, L. J.
Weaver, C. F.
Weston, M.
Wheatley, J. H.
Whitcomb, F. O.
Whiting, H. F.
Wickson, F. R.
Widden, W. E.
Winship, R. B.
Wood, R. J. H.
Woodham, S. J.
Yost, W. H.
Young, C. E.
Booth, W. A.

The next item is the reading of the minutes of last month's meeting; as these have been printed, and I understand from the Secretary, distributed through the mail, we can dispense with the reading of them. The third item of business is the "Remarks of the President." Well, gentlemen, I am very pleased to see such a large number of you here to-night, but there is one thing I want to take back. I think it was at the last meeting that I remarked that the first, second and last name of the members of the Canadian Railway Club and railway men in particular was punctuality. This meeting is supposed to start at 8.30 p.m. and it is now 8.45 p.m. Gentlemen I would urge upon you to be punctual. Let us get away on time, give the speaker a chance and give everyone present a chance to get into the discussion and leave at the appointed time.

The Secretary will now read the names of the new members.

Secretary: (Mr. W. A. Booth)

The following applications have been received since our last meeting:—

NEW MEMBERS

Albright, F. W., Foundry Supt., Adirondack Steel Foundries Corporation, Watervliet, N. Y.
Balkwill, H. A., Car Acct., G.T.R. System, Montreal.
Dow, A. W., Investigator, Claims Dept. G.T.R., Montreal.
Lafleur, L. M. G., Clerk, C.P.R. Angus Shops, Montreal.
Milord, J. P., Manager Municipal Stores, City of Montreal.
Pashley, G. W., Canuck Sup. Co., 371 Aqueduct St. Montreal.
Rehfuss, O. C., Mech. Engineer, Canadian Steel Foundries, Ltd., Montreal.

Rimmer, A., Asst. Foreman, C.P.R., Angus Shops, Montreal.
Rowe, J. C., Investigator, Claims Dept. G.T.R., Montreal.
Stokes, W. J., Foreman, Loco. Dept. C. P. R. Angus Shops, Montreal.
Tubman, W. I., Audit Clerk, G. T. R., Montreal.

Chairman:

You have heard the reading of these names and all in favor for membership will please signify in the usual manner, saying 'aye.' (Carried).

The only new business we have on hand at present is the organization of the annual banquet. A committee has been appointed to look after this, and we can report progress on it. We expect to have someone named to speak to us, one or two gentlemen, and to have a good time in general. There is something I would like to say in connection with the banquet, but I will refrain from doing so until the January meeting.

In announcing the speaker of this evening, what strikes me are the first three words of the title of his subject, namely, "Present Day Tendencies" in car construction. When we speak of the present day tendencies, we proclaim that we are endeavoring to keep out of a rut. Things change so rapidly these days, that if we are not continually on the alert, and seeking by dint of study, research and experiment to improve and further develop that which already exists, we would soon find ourselves far in the rear and stagnating. To keep in the lead as one has said, requires intense application, complete control of one's feelings, the power of analysis of the individual, and, above all, the power to make the members of a concern feel at such ease that they are thoroughly comfortable and frank in their discussion of problems with which they are confronted. These are a few of the thoughts which have been suggested to me by the words "Present Day Tendencies." It has been said that it is a sign of old age creeping on apace when one starts to live in the past. We do not want this said of the Canadian Railway Club, and hence it is that we endeavor each month to bring before you a speaker who is a master of his subject.

Mr. E. R. VIBERG:

The title of this paper would lead one to believe that today's tendencies in car construction differ to a great extent from construction in the past, but this is not, in my opinion, the case, and reminds one of what Mr. Richard Moldenki says in one of his books dealing in the art of steel and iron making, "Verily, there is nothing new under the sun." He arrived at this conclusion by referring to the history of that particular

art, and which dates back many hundred years, and it is, therefore, no wonder that Mr. Moldenki arrived at this conclusion, and as we will see from the introduction of the subject pertaining to this paper in the following paragraphs, reviewing the period covering the earlier efforts and designs of equipment, we must conclude that his statement is correct.

It will be clearly noted that the management in charge of designing and building equipment in the early days of Railroading had the same object in view, as prevails to-day, namely, to improve and strengthen the rolling stock in order to meet the ever increasing demand from the Transportation Department for stronger and heavier capacity cars, and at the same time, having in mind reduction in dead weight, and increasing the revenue load.

In order to form some idea regarding this very important subject, and the difficulties encountered, it may be interesting, before proceeding with this paper, to first review the early history of the car-building industry, and with your permission. will herewith quote a few paragraphs from records covering this period.

PASSENGER CARS.

In early Railroading, there was little difference in appearance between the passenger car and the freight caboose. Some attempts at ornamentation were made by a few of the builders, but these were modest enough consisting simply of ornamental paintings, scenes from life more or less artistically executed, and very simple arrangements for comfort.

In addition to improving ventilation, candle light was provided for night travellers, and in cold weather, a stove in the corner of the car provided the heat which travellers had been accustomed to draw from each other, or in a small degree, from the straw with which the car floor had been covered.

As travel increased, however, and the necessity for better accommodation became apparent, the passenger car was lengthened, and its height increased, the ventilation was greatly improved, and sanitary conveniences of various kinds added.

A great step forward was taken when provision was made for sleeping in a recumbent posture. A night car with rude sleeping berths such as is used on steamboats, but furnished with no bedding, was the first form of sleeping car which surprised and delighted the travelling public.

This car was introduced on the Cumberland Valley Railroad in Pennsylvania, in 1836, and in November, 1838, the Philadelphia, Wilmington and Baltimore Railroad put on a

similar car.

In 1854, Sleeping Cars, having the same general features as those now in use, were introduced. These cars provided seats for about sixty passengers, and at night, these seats were converted into flat berths. The Inventor was Theodor T. Woodruff. The license to build and operate these cars was later acquired by Webster Wagner.

Pullman Sleeping Cars were introdueed in 1864 and 1865. In 1867 a Hotel Car, the first in use, was built by him for the Great Western Railway of Canada, which road in August, 1882 was absorbed by the Grand Trunk Railway, and to-day is a part of this System, and in 1868 Wagner built the first two drawing room ears ever run for pay. Various styles of special cars have since been built, namely, the Observation, Library, and Dining, Combination Baggage and Dining, all of which are worthy of mention.

For supplying heat alone, improvement in processes to the number of several hundred have been patented. Heating by salt water circulation onee displaced the use of stoves, but afterwards, steam heating was substituted, and most ears constructed to-day, are equipped with Heating System which takes steam from the locomotive.

In lighting passenger cars several forms of compressed gas have been substituted for candles and oil lamps. ALL CARS NOW BUILT ARE GENERALLY EQUIPPED WITH ELECTRIC LIGHTING.

FREIGHT CARS.

The introduction of steel rails led to the construction of heavier freight cars, for it was soon found that such rails would bear heavier loads without danger. By increasing the dead weight of the car from, say 18,000 lbs. to 21,000 lbs. its carrying capacity was increased from 20,000 lbs. to 30,000 lbs. etc. The carrying capacity ean be increased faster than the dead weight of the car, and thus, the paying weight constitutes a larger percentage of the total load hauled.

The construction of wooden ears of a greater capacity than 70,000 or 80,000 lbs. not being practical, because the increase in size and weight of parts would increase the dead weight and decrease the revenue load, the capacity of cars, however, had to be increased but owing to the increased cost and the scarcity of suitable lumber, some other material had to be introduced, and as a consequenee, in the year of 1897, Steel Freight Cars began to make their appearance commercially.

The normal freight car in 1870 weighed 18,000 lbs. and had a carrying capacity of 20,000 lbs., and the following table of averages shows conclusively the progress made ' the relative increase since 1876 in dead weight of cars and revenue load, up to the present day.

Year	Dead Wt. of Car	Wt, of Rev. Load	Total Wt. Loaded	Wt. of car Percentage of Total	Rev. Load Percentage of Total
1876	20,500 lbs.	20,000	40,500	50.60	49.49
1882	24,000 lbs.	40,000	64,000	37.50	62.50
1889	27,700 lbs.	60,000	87,700	31.60	68.40
1895	36,000 lbs.	80,000	116,000	31.04	68.96
1920	48,300 lbs.	120,700	169,000	28.53	71.47
1921	78,900 lbs.	236,100	315,000	25.04	74.96

This table is indeed interesting, as, while it shows 285% increase in dead weight of present day equipment over the earlier type, it shows also, that the earning capacity has been increased by 1080% over the old and small car used in the early days of Railroading, showing the great strides made in car construction since 1876.

This will conclude my remarks regarding the historical part of this art, and I will now endeavor to deal with the present day's inclination in this industry.

As very few passenger cars were built between 1914 and 1919, the different Railroad Companies ordering cars more or less duplicated their designs, with the results that very few, if any, changes have recently been made in basic designs. It might, however, be in order to mention some details of construction which have been considered for recently built equipment.

In a general way, to-day's tendencies in car construction consist mostly in improvement of present designs, and may be summed up as follows:—

1st. TO IMPROVE THE PRESENT CONSTRUCTION.
2nd. TO ELIMINATE PARTS.
3rd. TO LIGHTEN EQUIPMENT.
4th. TO REDUCE FRICTION.
5th. TO USE COMMERCIAL RUN OF STEEL.
6th. TO USE RUST RESISTING MATERIAL.
7th. TO IMPROVE INSULATION.
8th. STANDARDIZATION OF COMPONENT PARTS.
9th. TO PRESERVE THE EQUIPMENT BY IMPROVED PAINTING.

Among these I shall deal with the various branches of construction and details.

IMPROVED CONSTRUCTION.

The principal efforts of builders, in conjunction with various Railroad Officials, have been to improve underframe and draft gear conditions and details in connection with protection and safety of passengers, and greater comforts for travellers. One detail, however, until recently, did not receive the attention it should; this important part is the coupler. During the development of the car bodies and trucks, all parts being increased and strengthened, heavy capacity Friction Draft Gear and Buffer applied, providing adequate strength for carrying load, and preventing, as much as possible, collapse in wrecks, the coupler remained much the same and, consequently, resulted in coupler failures. The 5 x 5 long shank coupler with the old type of head, used for so many years for passenger cars will soon be obsolete, however, as the latest equipments built are all equipped with Class "D" A.R.A. Standard head couplers, with shank of proportionate strength to the coupler head.

By the use of this coupler, and by increasing the present inadequate coupler side clearance, it is necessary to arrange for the Air, Signal and Steam pipes to oscillate with the coupler to prevent tearing of hose connections. This is accomplished by a special design of combination coupler and pipe carrier, or simply a separate pipe carrier which will work with the coupler and maintain a fixed relation between coupler shank and pipe connections.

As the wood body construction for passenger cars disappears, so also the composite wood passenger trucks have become obsolete, and are being replaced with the modern cast steel truck, as at present, all passenger trucks are invariably specified to be cast steel, which trucks have passed the experimental stage long ago and have proved very much superior, and incidentally eliminate about 50% of the parts necessary for the wood trucks. The cast steel trucks also afford better facilities for application of clasp brakes, as the tendency now is to equip all passenger trucks, both 4 and 6-wheel, with this type of brakes.

The present tendencies indicate that not only centre sills and draft gear are being given due consideration, but all parts entering into construction of cars are carefully analysed, and considered for strength consistant with dead weight, making all parts possible interchangable, eliminating a great number

of otherwise necessary parts, and in this way obtaining effective and economical construction.

The platforms have also been strengthened considerably to prevent telescoping, and the old built-up construction with its multiplicity of parts, more or less discarded for the more modern one-piece cast steel buffer casting, to which center sills and other members are joined. These castings are generally so designed that all attachments such as safety chains, buffer and draft gear, can be readily applied, and easily detached in case of repairs.

Underframes of various types have been used, but the majority of cars now built are equipped with fish-belly type centre sills. Great care must be exercised in designing centre sills keeping the resultant line of forces, due to draft gear and buffer end shocks, located on the centre line of gravity of section, or below, if possible, so that combined working stresses in compression and tension members will not exceed the elastic limit of the material. This can readily be accomplished with centre sills composed of rolled channel sections; that is, centre sills having uniform depth throughout, but this type of centre sill is not very extensively used on account of its weight and deflection, except for short cars, and fish-belly type centre sills seem to be preferable for all cars of extreme length, and with this type of centre sills, the features mentioned above must be carefully analysed and provided for by the proper distribution of the various sections employed.

The super-structure of Passenger Cars has been changed considerably in recent years. One of the greatest and most radical departures was the elimination of the outside and inside gothic sashes, and the elimination of the vestibule end windows and upper deck sashes, all relics used for many years in wood passenger car construction. The elimination of gothic sashes effected great economy in construction and incidentally removed numerous places for air leakage and draught, also facilitating a more sanitary construction as it was impossible to keep the art glass clean. Economy was also effected by the elimination of vestibule end windows. The upper sashes considered necessary for ventilation were substituted by exhaust ventilators also a great improvement in the right direction for ventilation, effecting economy in construction to a large extent as well as improving the appearance of the interior of the car.

Some attempts have lately been made in recent designs to eliminate as many pressed steel parts as possible, consis-

tent with economy, and some designs have been prepared having rolled angles for side posts, instead of pressed steel shapes. This is an advantage inasmuch as it overcomes, to a great extent, variation in the structure which it is impossible to eliminate entirely when using pressed steel parts. The angle post also affords better facilities for attaching furrings for the inside finish, especially if wood interior is used, and most cars built in this country, on account of climatic conditions, are fitted with wood interior finish, this makes an ideal design.

Some years ago a law was passed compelling all Railroads to equip all cars for interchange with automatic couplers; this primarily to prevent accidents caused to the crew when coupling cars. Very little progress has been made, however, towards also automatically coupling the air and steam connections. Many devices have been tried but have not given satisfaction; but developments are still progressing, and I believe Railways would be justified in applying some devices now on the market, which, while not perfect, would be a great progress towards speeding up making up the trains, and preventing accidents, and would, consequently, effect a great saving to the Railroads.

REDUCTION OF DEAD WEIGHT OF EQUIPMENT

This question is one that needs serious consideration before final decision is arrived at, as, before dead weight of cars can be reduced, having in mind present capacities, corrosion, loads and shocks, a grade of material having higher elastic limits and ultimate strength will be necessary for car construction, or alloy steel of a lower specific gravity, of equal strength in pounds per square inch, and same elasticity, as material used at present time. To lighten equipment by using higher fibre stresses in calculation of designs will not result in a satisfactory solution, as stresses produced in service, based on assumed loading and buffing shocks, are as high as it is physically possible to employ without producing fibre stresses in material in excess of the elastic limit.

It is quite evident from some cars, built only a few years ago, now under repair, that material has been subjected to stresses in excess of its physical limits.

The reduction of dead weight of equipment is important from so many view points, and, therefore, merits the most exhaustive investigation.

Assume the use of steel having an ultimate fibre stress of 100,000 lbs. per square inch, and a factor of safety of 3; this would allow a working stress of 33,000 lbs. per sq. inch.

or an increase of 100% over safe fibre stress with present material. This would revolutionize designs prevailing to-day, and make a great saving in weight.

REDUCE FRICTION.

Journal Boxes equipped with Roller Bearings are commencing to make their appearance in steam Railroad equipment. A few years ago the Grand Trunk Railway had a number of cars so equipped. The importance of reducing frictions is now being very seriously considered by many of the Railroads, and roller bearings are being tested out by some of the Railways in the States and while it may be a little premature, at this time, to judge of their merits, or the extent of their use, I venture to say that before long they will be used as a standard for passenger cars, as tests will undoubtedly show a great saving in fuel consumption, due to decreased friction, both for starting and running, saving in time and lubrication, and will also remove, to a great extent, the delay caused by journals running hot.

Tests made for a number of years have proven conclusively, that roller bearings will save from 10% to 15% in power consumption, and effect a saving in coal of 10%, which is an item worth while considering, particularly as the coal becomes more expensive and difficult to obtain, and when electrification is more established, the use of roller bearings will cut down the present current consumption about 17%.

Roller Bearings for Railway Equipment, while new in this country, have been used for a number of years in Europe, for both freight and passenger equipment, and have now been adopted in some countries as standard.

COMMERCIAL STEEL.

When steel was first introduced for Passenger Cars, it was the general opinion that it would be necessary to make the exterior of a steel passenger car of the same appearance as the wood car, namely, to conceal the rivets by applying mouldings over the rivet heads, and in order to obtain a perfectly flat surface, cold rolled steel sheets were introduced at a very high expense.

The present day practice, however, is to make the steel car of an appearance that will convince the travelling public that they are actually travelling in a car of steel construction which will afford better protection for passengers in case of collision, and, consequently, great strides have been made in this direction, and instead of the high priced cold rolled steel

sheets formerly used, commercial run of steel, as produced by the steel Companies, is being used in passenger car construction, and may be referred to as follows:—

1. It is useless to pay excess cost for special rolled steel sheets, when in applying, they are almost certain to become distorted.

2. As a general proposition it is a case of taking such a quality as the mills will supply.

3. It may sometimes be advantageous to pay the extra cost for special processes, such as "patent levelling," but in this case, you can only obtain sheets in about 12 ft. lengths.

Since commencing the building of steel passenger cars on commercial basis, we have been confronted with the question of obtaining flat sheets. This was possible, and could be readily obtained when using sheets of heavy gauge, but cars in recent years have been built with light gauge sheets in order to reduce dead weight, and this has resulted in buckles appearing in the completed structure, which, unquestionably, is objectionable, but difficult to overcome. Buckles are also caused by car framing such as side sills, belt rails, posts, and all other members in contact with the sheets, not being absolutely true and in perfect alignment, and in consequence will appear in the sheets after rivetting. Also upon removal of the supporting stands, used during rivetting up, buckles will appear in the sheets after complete erection due to the natural deflection of the car structure from its own weight, and may be explained with the following remarks:—

The appearance must be as good as it is economically practical to produce, without sacrificing strength. Formerly it used to be the practice to doll up the exterior, and also the interior with gold and other decorations, but to-day's tendency is to make the cars of a plain, sanitary, comfortable, design. It has often occurred to the writer that the Railroads would be quite justified in spending less money for their equipment, as I have observed many times during my travels, from the abuse of equipment by the travelling public, that they either do not care, or have no idea of the expense involved in producing equipment such as the Railway Companies are using to-day. As a matter of fact, while travelling, I have talked with many passengers who have been greatly surprised when they were informed of the cost of the modern passenger equipment placed at their service, and for their comfort, and I think a campaign should be started by the Railway Companies, educating and informing the travelling public of the expense and efforts taken by the Railways

in building and maintaining the present costly and modern equipment. I am fully convinced that the Railways would be well paid for any expense incurred in such an educational campaign, inasmuch as a large percentage of the travelling public would be more careful and considerate, and rather than destroy, they would try and preserve, and help the Railroad to reduce cost of operation, thereby helping themselves also, as Railroad fares, like many other things, are based on costs.

RUST RESISTING MATERIAL

The steel car has undoubtedly proven superior over the all-wood car in many important respects, but here again we have, instead of decayed lumber, another evil—corrosion, which constantly works away on the structure until it is unsafe or not able to stand the loads and shocks incident to the service. Therefore, the tendency to-day is to specify copper bearing steel to overcome, to some extent, excessive deterioration, and some roads now specify all sheets and plates 1-8 in. thick and over to be of this grade material, and I understand that other roads specify this material for rolled shapes, as well as for plates for passenger cars.

This material is also specified by many of the Roads in the States for freight cars, and particularly for parts which come in contact with the lading. It takes an extra above standard base price of ordinary O. H. Steel of similar sizes and shapes, but this is negligible if final result, as expected, can be obtained, as the extra cost of copper bearing steel would only amount to 1 1-2% of total cost of the new car at present price, which amount could be recovered in less than one revenue trip.

The roof has received considerable attention lately. As we all are aware, the majority of passenger cars built in the States, and also some built here, have been equipped with ordinary O. H. Steel roofs, which roofs are now causing a great deal of worry and expense to the Railroads, due to corrosion, and copper bearing steel is now most extensively specified for passenger car roofs expecting that the use of this material will solve this troublesome problem. But this remains to be seen.

One large car-building concern in the States, that not only built cars for the Railroads, but also owns and operates cars, recently constructed, for test and for comparison, a number of cars using wood roof covered with canvas, and also a number of cars using galvanized iron for roofs, but as yet they are not in a position to judge as to the final roof to adopt.

The wood and canvas roof as most extensively used in this country undoubtedly has a longer life.

INSULATION.

Steel in passenger cars, due to its nature, demanded improved insulation, but it is evident, from some designs, that this important feature has been sadly neglected or misunderstood. Some attempts have been made to make up the deficiency in insulation by increasing the heating facilities, and these have proven costly to the Railways, for reasons well known. As the benefit of better insulation is being understood, and is now considered absolutely necessary from both the Railway's and Passenger's standpoint, great improvements have been made in this direction, and cars built to-day, are, as a rule, insulated with material having a thermal efficiency, (based on table prepared by the National Bureau of Standards for Thermal Conductivities of Materials), that will not transmit more than 2.68 B. T. U. of heat per square foot of surface in 24 hours for each degree F. difference in temperature inside and outside wall of section, and 3.62 B. T. U. for Floor.

The only data available, covering requirement for insulation, is the Mail Service Department Specification for Mail Cars, and which Specification specifies that Mail cars must be insulated with sufficient material of Thermal efficiency that will not transmit more than 8 B. T. U. of heat for side wall, ends, and roof, and not more than 7 B. T. U. of heat for floor per square foot of surface in 24 hours for each degree F. difference in temperature.

A coach or sleeping car requires more efficient insulation to overcome increased radiation and conduction, due to greatly larger area of glass and increased leakage of air around the numerous window openings.

Wood and canvas roofs need no insulation except between steel carline and headlining, compared with a car having a steel roof, which necessitates considerable insulation to protect the passenger from conduction of cold in the winter, and heat in the summer.

Roof construction as used by some of the Roads to-day gives a B. T. U. transmission of heat of 6.8 per square foot per 24 hours per degree F. difference in temperature and is composed as follows:—

Roof Canvas.

13-16 in. Roof Board.

Air Space.
1-4 in. Salamander.
Headlining.

It will be seen that this construction gives, with only a small quantity of insulation, better results than the requirement for Mail cars, and should be satisfactory, but it cannot be denied that improved insulation even for cars with wood roof would make it possible to heat cars with less steam, consequently, saving fuel.

Due to vertical members in framing, insulation cannot be applied to the car in continuous lengths, but must be confined to length suitable for individual spaces. It is, therefore, imperative, in order to prevent conduction, to use an insulating medium between all surfaces of steel in contact,, and to isolate the outside steel plates from inside framing member so as to obtain an uncombined form of construction, otherwise, in cold weather, frost line will appear on inside of car.

STANDARDIZATION

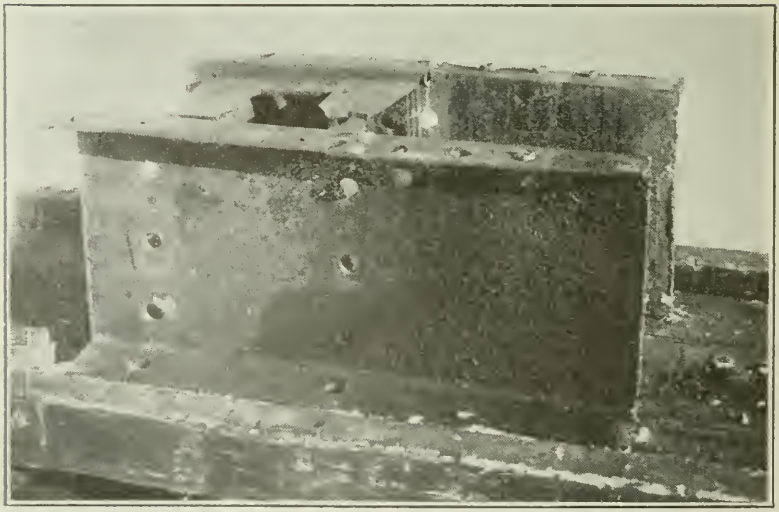
In the earlier stages of Steel Car designs, the sizes of material were more or less based on the members used in wooden car construction, and, consequently, many of the early designs of freight cars proved defective, but served to develop a better knowledge of the relative value of steel and wood in car construction, and the use of the elastic limit rather than the ultimate strength.

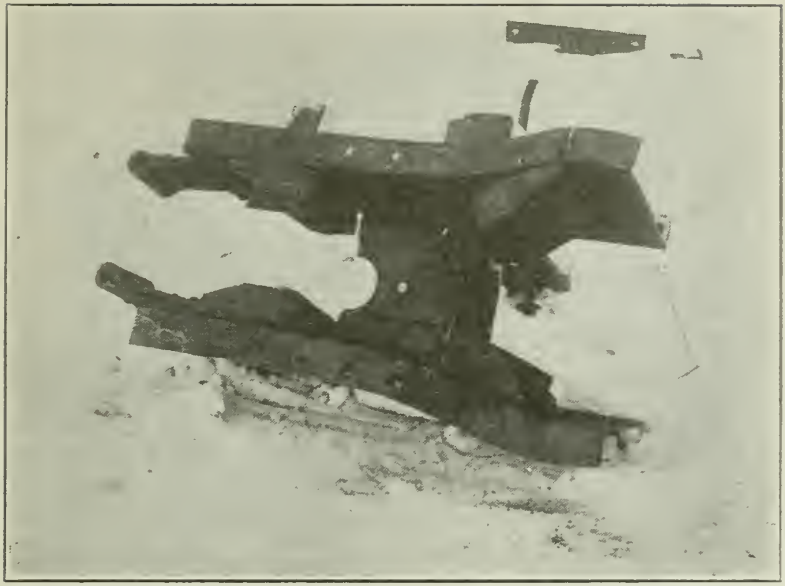
The car constructed with wood underframing, and wood draft timbers attached with bolts to the centre sills, and with spring draft gear of a very light capacity, formed a very resilent structure, but when steel was introduced into car construction, while it naturally developed a more rigid design, it has reflected itself in local damage to some of the members of the car, and has also resulted in damage to the lading. The principal member, is the design of centre sills, which, together with draft gear, have become a very live issue, the centre sills to form a sustaining beam of sufficient strength to not only carry the load, but must also form a column to take care of direct and indirect stresses, caused by buffing, the draft gear to form a shock absorber, protecting the car structure and the lading.

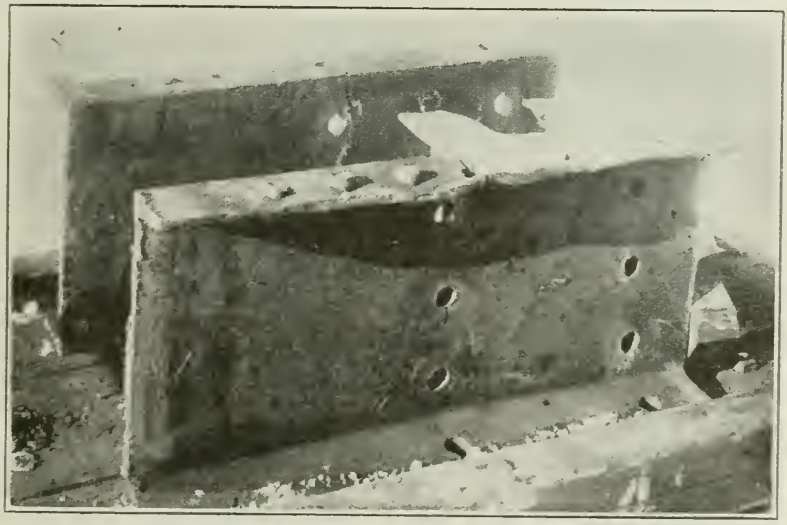
Results of spring draft gears in steel equipment have proven inadequate and costly and not of the capacities required and are now being entirely eliminated in modern equipment, and replaced by heavy capacity long travel friction gears ap-

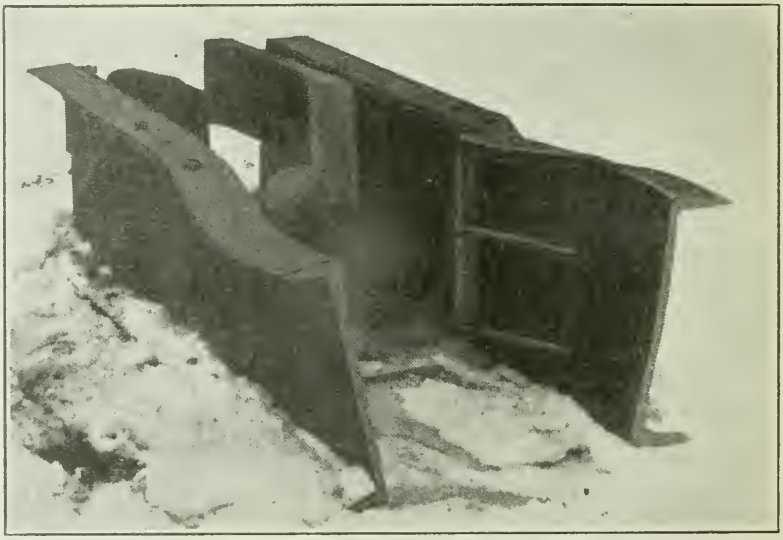
plied to cars so that at no time will coupler horn come in contact with buffer casting, but instead transmit the buffing shock to centre sills at rear draft lugs, which incidentally reduces the length of that portion of centre sills which must absorb stresses due to buffing. With the spring gear and the final buffing shock taken by the buffer block, the column is increased considerably and naturally makes a weaker structure.

Many publications have been written about the defects in the early designs of steel Freight Cars through lack of knowledge of the designer referred to in the preceding paragraphs. But in spite of all the publicity given, cars are built to-day from designs which are very little better than cars built in the early days. I had occasion, some time ago, to analyze a recent design of car, which design showed combined stresses as high as 35,700 lbs. per square inch in center sills, some of which cars, no doubt, due to high stresses and rough handling in the classification yards, have landed on the repair track with failed center sills, together with many thousands of the older cars, as per specimen shown on reproductions herewith, and which speak for themselves.









In 1907 a very important change was introduced in Box Car construction, when the Steel Underframe, Steel Superstructure Box Car made its appearance, which car has become almost the Universal car, and to-day remains, except for minor refinements, much the same as the original design, and as the steel Underframe took the place of the wood underframe Box Car, so also now the Steel Frame Box Cars are rapidly replacing the Steel Underframe Wood Superstructure, due to the impossibility of keeping the wood superstructure in repaid on a rigid steel Underframe. The posts and braces work loose, the frame and roof shift in either direction in heavy shunting, under which condition, it is impossible to keep sheathing, lining and roof on the car for any length of time.

Hand Brakes are improved to meet the A.R.A. requirements, and in order to obtain more efficient Brakes, some cars, recently built, have been equipped with geared brakes, and large numbers of cars are being equipped with lever brakes, which have certainly resulted in a great improvement over the old and inefficient hand brake wheel now in general use.

Steel, since its introduction in car building has not altogether replaced wood, which is used in Passenger Cars for furrings and interior finish. For Freight Cars, large quantities of lumber is, and always will be, used.

When building cars of all wood, little attention was given to the moisture contents, which it is so important and necessary for good construction, to consider. Good dry lumber, as proven by test, becomes approximately 2 1-2 times stronger than the wood as it comes from the tree, and as this important feature becomes thoroughly understood, wood, when used, will form a construction that will last longer and make more satisfactory material where it is required.

It is the tendency to-day to construct freight cars having steel framing and wood lining and flooring, not only for box cars, but also in many types of open cars. This construction is preferable from a maintenance standpoint as being more economical, and repairs can be effected without expensive shop equipment, and it is my opinion, that this construction will be used in the future, as the all steel car, due to corrosion, has a very short life, and is expensive to repair, unless the use of copper bearing steel, now so extensively specified, will overcome this deterioration.

Lumber, when used in freight cars to-day with steel framing, serves only one purpose, that is, to retain the lading or form supports, and as lumber is classified by grade, it would lead to great advantage and economy to both builder and Railway, if more consideration was given to this subject when preparing specification, that is, use a good grade of lumber for flooring and lining for box cars, and a lower grade for roofing, particularly as cars to-day are mostly equipped with outside metal roofs. Similar examples also apply to other types of equipment, such as, coal car and refrigerator.

Regarding the proper moisture contents, it is comparatively simple to dry all lumber in a reasonably short time with the new modern dry kiln, unless Oak is specified, which lumber requires a long time to dry. It will take, depending on the sizes, from four to ten months to dry Oak framing of sizes specified for car equipment.

The Freight Car trucks have received due consideration; wheels have been redesigned and increased in weight, rating of axle carrying capacity increased for some capacity cars, and arch bar trucks, which have for so many years been used, are being replaced by more modern cast steel truck frame, and to-day in the States 90% of all freight cars built are being equipped with cast steel Truck Side Frames.

By the use of this class of truck, many parts are being eliminated, and it may be interesting to some member of this

Club to know the relative number of parts used, and, therefore, submit the following table:—

Type of Trucks	Capacity.	No. of Parts.	Weight Two Trucks.	Parts Less.	Weight Less,	Reduction in Parts %	Reduction in Weight%
Arch Bar...	40-ton	268	14400 lbs	....	.....	.....	.....
Cast Steel...	40-ton	128	14000	140	400 lbs	52%	3%
Arch Bar...	50-ton	304	17000 lbs	....	.....	.....	.....
Cast Steel...	50-ton	144	16123 lbs	160	877 lbs	53%	5%

This comparison is indeed very interesting and shows a reduction in parts of over 50%, in favor of the cast steel truck, and also a reduction in weight, which, although small, is sufficient to receive consideration. Both reduction in parts and reduction in weight should appeal very strongly to the Railway Officials in charge of construction and maintenance, and should also appeal to the Transportation Department, as the elimination of so great a number of parts also eliminates, to a great extent, the many delays caused by the failures of the present arch bar trucks which depends on bolts for securing the parts in contact one with the other, and which bolts after a short time in service, become loose, and the truck and car lands on the repair tracks instead of being in service, returning revenue to the Railways.

As the trucks are being modernized, attention has also turned towards obtaining better brake rigging, and there is a tendency to equip freight car trucks with clasp brakes. Some heavy capacity cars have already been so equipped, and I venture to state that all trucks for 50-tons capacity car and over will eventually be specified to include clasp brakes.

Advance Paper Galley 6—

Truck spring failures have become quite serious of late, and this is due to some extent to the recent increase in loading, or on account of the change in method of stencilling the capacity, based on axle carrying capacity, and increased rating of axles having 5 1-2 x 10 in. Journals without any alteration in classification of truck springs. Failures have become so alarming that the A.R.A. recommended, in 1921, the use of alloy steel and an entirely changed method of manufacture, which, if adopted, would make the springs very much more

expensive, and would not solve this serious problem as will be seen. I believe that these failures can be reduced, and possibly eliminated altogether, if the present standard of springs was reclassified, using Class "D" for 80,000 lb. capacity cars, and Class "H" for 100,000 lb. and 120,000 lb. capacity cars, as this would reduce the working stress in spring to about 50% of the ultimate allowable stress.

TABLE SHOWING EXISTING CONDITIONS

Class Springs.	For Cap. Cars A.R.A.	Cap. of S ring at 80000 lbs. per Sq Inch Fibre Stress.	Total Load on Each Nest.	Total Deflection of Spring at 80000 lbs, Fibre Stress.	Percentage of Total Deflec due to load and car body.	Percentage of Total Allow able Stress.	Fibre Stress in spring due to load and car body at static. Lbs per Sq. Inch.
A	60000 lbs	40412 bs	23125 lbs	1 7-8"	57%	57%	45600 lbs. Sq. In.
C	80000 lbs	56320 lbs	29875 lbs	1 11-16"	53%	53%	42500 lbs. Sq. In.
D	100000 lbs	63148 lbs	38475 lbs	1 11-16"	1	61%	48900 lbs. Sq, In.
H	**	79145 lbs	38475 lbs	1 11-16"	49%	49%	39200 lbs. Sq. In.

* Shows conditions that would exist if A.R.A. Class "H" Spring was used for cars with 5 1-2 x 10 in Axles.

Conditions as existed under old loading rules for 50 tons capacity car:—

Average Dead Weight Car Body and Truck	42,000 lbs.
Deduct Weight of two Trucks	17,000 lbs.
	25,000 lbs.
Add for two Truck Bolsters	1,800 lbs.
	26,800 lbs.
Load plus 10% for Overload	110,000 lbs.
	136,800 lbs.

Load on each nest of truck spring $= \frac{136800}{4} = 34{,}200$ lbs.

From figures in table for same capacity car, it shows increased static load of 4,275 lbs. on each nest, or a total increased loading on the four nests of 17,100 lbs. or 12.5%.

The increased load, while not large, must have some relation between past and present spring failures, as it is general practice to design springs, all conditions being known, so that the static load will not exceed 50% of maximum load at 80,000 lbs. per sq. inch fibre stress for helical springs.

Stresses as shown, however, while a factor in causing spring failures are not the most serious, and are due to static

loads only. Other forces are introduced, and which create additional stresses, and load caused by these forces must be added to the static load in order to obtain final results.

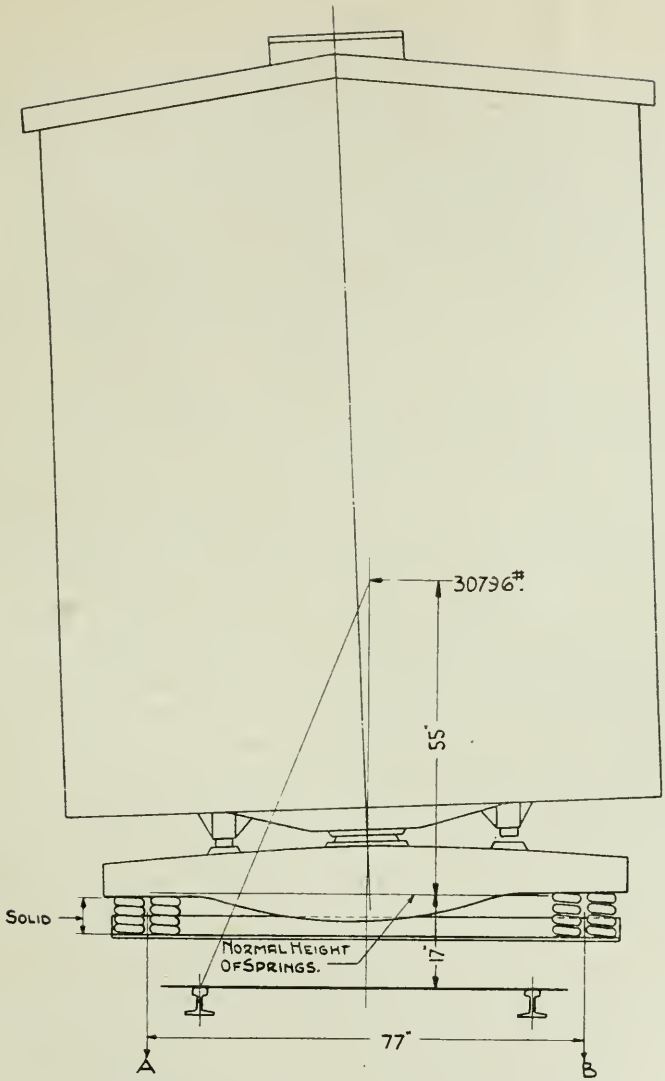
As stated in the M.C.B. proceedings, volume 30, it can be proved that if the centre of gravity of the car is 72 inches above the rail, that 40% of the static load acting horizontally will almost entirely relieve the weight on one rail, which also acts on the springs, and to this we must add 26% of the static load for vertical oscillation to obtain the combined load on each spring.

I have taken for this example a 60-ton capacity box car, axle capacity 169,000 lbs. which, as shown on diagram, produces a static load on each nest of springs of 38,495 lbs.

Horizontal force 40% of load equals 21,997 lbs. which must be added to the static load on one set of springs and deducted from the static load on the other set of springs. To these figures the load due to vertical oscillation must be added, which makes a total load of 76,218 lbs. on one set of springs, and 20,787 lbs. on the other set per truck.

From this you will notice that under these conditions one set of springs are solid as the weight upon them exceeds the capacity of Class "D" Springs by 12,218 lbs. and as the springs are subjected to these conditions time and again, only one result can be expected, which can only be remedied by introducing springs having greater capacity and being more suitable for conditions imposed.

(Continued on Page 40.)



A	B
38495	38495
21997 +	21997 −
60492	16498
15726 ← 26% For Vertical Oscillation	→ 4289
76218	20787

Weight On Bolster Springs = 169000 − 16920 [Trucks] + 1900 [Truck Bolsters] = 153980.#

Weight On Each Set Of Springs = 153980 ÷ 4 = 38495.#

Horizontal Force = 40% Of 76990 = 30796#

Transfer Of Load At A & B Caused By Horizontal Force $= \frac{30796 \times 55}{77} = 21997$#.

REFRIGERATOR CARS.

A few remarks regarding Refrigerator Car designs and construction may be in order. This is a car that perhaps transports the most valuable and most expensive commodity handled by the Railroads, and incidentally a car that necessarily must carry cooling elements (ice), which is a dead loss in two directions, namely, the initial cost of ice, and the weight of the ice which is carried without revenue, but although the Railroads have been faced with these losses for years, very few attempts have been made to improve conditions until recently, no doubt for the reason that no data has been available making it possible to check losses of radiation and conduction, and select the proper insulation material and amount required to obtain results reducing the losses incident with this equipment.

It has been made possible, however, due to recent investigations into the conductivity of insulating material, to calculate rather than conjecture what insulation, and amount, to use, and it is apparent that great improvement has been made in recent designs, and some cars built have been insulated with sufficient material of thermal efficiency that will not transmit more than 2.6 B.T.U. of heat for wall, floor, and roof sections per square foot of surface in 24 hours for each degree F. difference in temperature, but this is not sufficient, and greater improvement must be made in insulation of refrigerator cars, and thereby reduce the losses above referred to. The extra cost of insulation would be insignificant compared with the saving, as I am sure that the present ice consumption can be reduced 50% with better insulated cars.

In modern design of Refrigerator Car the side insulation is required to run in one piece from door post to door post, and to be of sufficient width to run from side sill to side plate, which construction is ideal, but the old method of applying insulation in floor and roof is still maintained, namely, to apply insulation material between wood sills and carlines, and which design invites poor construction on account of the numerous joints and furrings which may be fairly tight when car is new, but after a few months service are bound to become loose and defeat the purpose intended.

I would therefore, suggest that floor and roof insulation be applied in the same manner as used for sides, namely, in one piece covering the entire area, securely attached all around eliminating all leakage possible. This will be a step in the right direction, and will make insulation more effective as

well as reduce cost of application.

Most refrigerator cars to-day are constructed with Steel Underframe of a rigid design, with wood frame superstructure, but why not go a little further and apply steel framing for this class of equipment as well as for box cars. The steel superstructure will form a rigid support for sheathing, insulation and lining, and will hold them securely together and prevent radiation and conduction through the cars on account of the inadequate wood framing as used in most of the Refrigerator Cars in service to-day.

PAINTING.

In conclusion wish to refer to one of the most important, but from observation, the most neglected requirement for preservation of equipment; this is PAINTING. Generally particular care is taken to supervise the erection of the car so that the final structure will represent design prepared. After leaving erection shop for the paint department, it has been customary to paint the exposed surfaces only, and the unexposed surfaces, which are almost impossible to inspect for deterioration, left entirely unprotected, and which practice has resulted in the structure ending in a premature death, and costly replacement for the Railways. I may here state that this applied more to freight cars than to passenger cars.

In view of this experience, the tendency now is to give the painting of cars the attention warranted, and the equipment built of late has been painted with the utmost care. While the initial cost of good painting will amount to a few additional dollars per car more, the cost of proper painting is, after all, comparatively small when compared with the total cost of the car and is money well spent, as undoubtedly the life of the cars can be increased several years.

To obtain good results, however, it is, of course, necessary to clean by sand blast all steel parts before any painting is attempted.

While this paper primarily was intended to deal with present tendencies in Car Construction, and which have been dealt with, it may be interesting to also refer to the program made by the Railways in replacing the existing old wood cars.

The program of replacing Passenger Wood Equipment with steel has been quite rapid in Canada, as will be shown, and the percentage of such replacement has exceeded those of the United States Roads by a considerable margin.

From the last report, issued by the Interstate Commerce Commission for December, 1919, as referred to in 'Railway Age' dated January, 1922, which is the only record available, the increase in Steel Passenger Cars in the United States for the last three years has only been at the rate of about 3.2% wheras in Canada during the same period, the increase amounts to about 9% of total cars owned and operated, which record is, indeed, gratifying, but there is room for great improvement yet as from statistics, out of about 7,040 Passenger Cars in Canada, only 17% are of Steel Construction; balance are of wood.

Similar conditions prevail regarding Freight Cars. The last report from the Interstate Commerce Commission shows a total of about 2,300,000 cars in the United States, out of which, 1,505,717 are all-steel or steel underframe construction, or a total percentage of 65.5%; balance of cars are all-wood construction.

From Statistics, Canada's position, in this regard, is not so good, as records show that out of 219,168 cars in Canada, 47% are all-steel or steel underframe construction, and the balance are wood construction, and I may safely state that 50% of these have reached, and some exceeded, the normal expectancy of life, and should be replaced by modern equipment.

In the United States, the annual retirement is about 72,000 cars, or a percentage of 3.1% of total, and it may be assumed that the same percentage should prevail in Canada, at which rate Canadian Roads should add about 7,000 cars per annum to maintain their present number of cars, and which figure does not allow for any increase to take care of increased normal growth of business.

The above statement may, or may not, be interesting, and perhaps not pertaining to the subject of this paper, but, nevertheless, facts which must be faced, and show that, unless some drastic measures are taken, tendencies will go backward instead of forward.

Mr. Edward T. Y. Ch'Iain:

I am not a mechanical man, nor a car builder. I am, I might say, at present studying in the Canadian Pacific Railway, in transportation. I have received a lot of interesting knowledge to-night in reading this paper. I am going to ask you a question on ball bearings for passenger cars. Will you kindly advise me what results have been obtained respecting service, maintenance, and other matters pertaining to upkeep

of the ball bearing journals for passenger cars and the advantages of it. I would like to bring back to China some news of it?

Mr. E. R. Viberg:

Roller Bearings are comparatively new in this Country, but have been used in Europe for many years, and have been adopted in Sweden as standard. This Country is, unfortunately, not blessed with large natural resources, such as coal, and, consequently, must look towards devices which will reduce power consumption to a minimum.

Regarding maintenance, might state that roller bearings have been in service on some cars since 1915, under a journal load of 7½ tons, maximum speed 60 km. per hour, and some of these earlier types have been replaced. In 1921, roller bearings were applied to a certain number of cars, none of which have been replaced as yet. These cars are running at a speed of 90 km. per hour, and make an average of 200,000 km. per year.

The initial cost of roller bearings is naturally higher than the ordinary friction bearings now used, but it has been found that roller bearings for passenger cars pay for themselves in about four years, through the saving of fuel and other incidentals.

There are some Roads in the States trying out roller bearings, and which cars have covered approximately 90,000 miles without any replacement. Roller Bearings have also been tried by the Great Eastern Railway, in England, and on the Continent of Europe, with great success.

Mr. G. M. Wilson:

Mr. Viberg referred to the Grand Trunk having ball bearings on trains. I was enquiring about this a short time ago to know the reason why the bearings were removed. All the information I got was that the train ran so fast that it was beyond the power of the air brake to stop it.

Mr. D. P. Lamoreux:

It has given me a great deal of pleasure to listen to Mr. Viberg's paper to-night. I notice, however, he refers to the Interstate Commerce Commission's report where they show the annual retirement is .031% of the total. Is that in reference to the life of the car?

Mr. E. R. Viberg:

The annual retirement of all freight cars has been approximately 3.1%, and only takes in cars that have been des-

troyed or retired on account of age and not in fit condition to be accepted in interchange.

Mr. D. P. Lamoreux:

Take 3%. That would indicate the life of a car would be 33 years, or, on the 3% basis, you would have to replace your entire equipment in 33 years.

Mr. E. R. Viberg:

You will note the figure is .031% which is a typographical error and should read 3.1%, and which figure is based on the report from the Interstate Commerce Commission and which report we must assume to be correct.

Mr. H. R. Naylor:

We have listened to-night to the splendid paper of Mr. Viberg, and I am sure it contains many points that can be discussed to advantage. I would like to ask Mr. Viberg if any attempt has been made, when building steel passenger cars having wood interior finish, to make the bulkheads of steel. Many of the cars built to-day are a steel shell, that is, the side and end construction are of steel but the bulkhead partitions are made of wood. It has occurred to me that these partitions could be made of steel and built in with the car framing and later finished with wood panels each side to harmonize with the balance of the interior woodwork. This type of construction would provide effective cross-sectional stiffening between the ends of the car and would overcome any possibility of the wood partitions creaking later, besides providing additional safety in case of accidents.

Passage partitions made of wood and costly to maintain, could be made of steel and finished with wood on the side forming the interior of staterooms, smokerooms, etc. The steel work on the passage side could be effectively decorated to harmonize with the wood finish in the body of the car. My idea is to reduce the cost of maintenance without taking away from the appearance or effectiveness of the wood partition, and I would be glad to have your ideas along these lines.

I would like to ask Mr. Viberg his opinion as to whether the application of steel underframes, or metal draft arms is the most economical when re-building wooden underframe cars built 10 to 15 years ago.

Reference has also been made to the reduction of deadweight. This, of course, is important, but in many cases weight reduction has been reduced to the detriment of the car and very often what is left off on the drawing board has to

be put back later on the Repair Tracks.

Mr. Viberg also touches on the damaging of passenger equipment in service. This, without doubt, is a very vital subject, and is fully appreciated by those familiar with the condition of the cars newly built or when they have received general repairs, and again going over these cars after twelve months service. This condition is not so noticeable on European Railways, and I think this is due to the Railway Companies educating the travelling public against damaging the equipment. Suitable notices are located in the cars advising of penalties for anyone found damaging the equipment, and I believe this could be followed up with good effect here.

Mr. E. R. Viberg:

Regarding Mr. Naylor's remarks relative to making partitions of steel, practically all cars built in the States are fitted with steel partitions. They are not part of the car framing, however, but simply applied in position with machine screws. This method of construction is preferable when steel partitions are used on account of variation in framing. The idea of building the car with partitions forming part of the car framing is good for stiffening and reinforcing but I doubt the wisdom of it as, in the case of repairs it would indeed be very expensive, and, as before mentioned, due to variation, it would be very difficult to obtain symmetrical construction which is so necessary for appearance in passenger cars. Personally, I prefer wood interior. This construction lends itself better for artistic appearance and makes a more comfortagle car, and requires far less heating.

The 2nd item referring to repairs to old cars: I do not wish to express myself very much on the subject of applying steel draft arms or steel underframes to old equipment. This is a matter for the Railway Companies to settle for themselves, and we, as car builders, will apply whatever construction they desire.

About reducing dead weight, I do not wish to impress anyone with the advisibility of reducing the dead weight of a car, thereby sacrificing strength, considering the shocks and stresses which the cars are subjected to during service. The stresses in many designs of cars are entirely too high, and above the elastic limit of material, and results of such cases are very apparent to-day. It is not possible to obtain good results without the necessary material, and sufficient material must be used in order to withstand the shocks which the cars are subjected to, and I do not think it advisable to re-

duce dead weight of car unless cars are more carefully handled in the classification yards, where the cars, in my opinion, receive the most abuse.

Mr. G. M. Wilson:

I think I will have to take exception to the remarks the speaker has just made in regard to draft arms. You know the Railway is the patient, and the Car Company is the doctor. Now, is the Doctor going to say, here are two kinds of medicine, which one do you wish to take? (Laughter).

Mr. N. E. Ross:

Mr. Viberg dealt on the reduction of weight in passenger equipment. There has been an increase in weight during the past number of years in this equipment, and the great majority of steel passenger equipment is fitted with the 5″ x 9″ journal on cars up to 160,000 lbs. Does he consider the 5″ x 9″ journal sufficient to carry the weight to which it is subjected?

Mr. E. R. Viberg:

Well, to that I may say there is only one way to take it. For a four wheel truck car, it is 132,000 lbs., now, if you have a car that has a dead weight more than this you should have a 5½″ x 10″ axle, otherwise hot boxes will be frequent.

Mr. N. Holland:

Mr. Viberg "said a mouthful" to-night when he spoke in regard to the painting of concealed parts of a car. This applies more particularly to steel equipment than it does to wood. Even in the old days of the wood equipment, there was too much neglect in painting concealed parts of a car. We have for years advocated that point. It is just as important that the back of the sheet be painted, as it is that the exterior be protected. It seems to be the opinion that in painting a steel car, so long as the outside is protected, the inside does not matter. This is wrong, because you see the deterioration that is taking place on the outside, whereas you do not see what is taking place on the inside. Rivets, joints, bolts, etc., on the car should get more attention than they get to-day. Are you protecting the parts the ordinary people do not see?

Mr. E. A. Robinson:

The speaker of the evening to whose able address I have listened with interest makes slight mention of automatic train pipe connections.

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As a result of these tests this is being tried out in Canada and results to date have been very satisfactory.

Mr. E. R. Viberg:

Regarding remarks in the paper relative to better insulation for refrigerator cars; in order to emphasize the importance of this feature and the saving in ice wish to state the following:—

When refrigerator cars are used in fruit service, 150 lbs. of ice per hour, or 3,600 lbs. of ice, is used for 24 hours, at an average travel per day of 30 car miles. Assume a car using ice six months per year in this service, or, 182½ days per year at 120 lbs. of ice per car mile equals 657,000 lbs. of ice per year, per car. This ice at a cost of $3.00 per ton equals $985.50 per car per year.

Assuming a Railroad having 3,000 cars cost of ice per year equals $2,956,500. The consumption of ice, of course, varies with the temperature, and from the average refrigerator car to-day which has been in service from 4 to 8 years about one ton of ice would be consumed in about 24 hours in a temperature deferential of approximately 50°. It has been proven that Railroads would be justified in increasing the insulation about 50% above the common practice of to-day considering the cost of ice to the Railroad. It is evident from the above that if a saving of ice can be accomplished, same would show a big profit both to the Railroads and to the Shippers, besides, perishable goods would be kept in a better condition, the number of claims for damaged goods from shippers would be considerably reduced, the consignee would receive goods in better condition and which would mean better prices for their products.

Mr. G. M. Wilson:

I am sure there is much more that could be said in regard to a car but as the hour is getting late would be pleased if some gentleman would propose a vote of thanks to Mr. Viberg for his very interesting paper.

Mr. R. A. Hamaker:

I would be pleased to make that vote of thanks to Mr. Viberg.

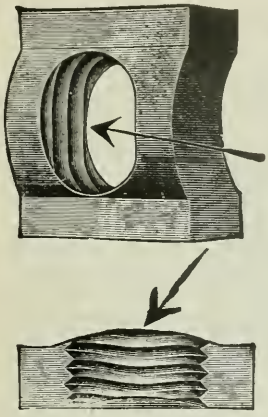
Seconded by Mr. W. H. McEwan.

Mr. G. M. Wilson:

Mr. Viberg, a vote of thanks has been passed by the members of this Club to you for your interesting paper to-night.

The paper for next month's meeting will be on "Kiln Drying of Lumber" by Mr. F. O. Farey, Chief Chemist of the Robt. W. Hunt Company, of Montreal, and as Christmas, Gentlemen, will be here before we meet again, I wish you a very merry Christmas and a prosperous New Year. Refreshments may be had in the small room at the rear on your right on the way out.

JOHN IRVING
DIED
DECEMBER 8th 1922



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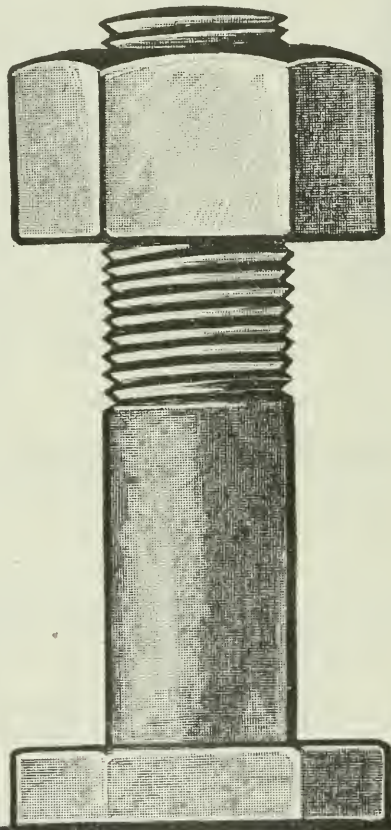

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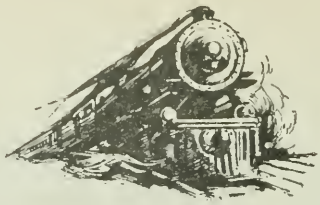

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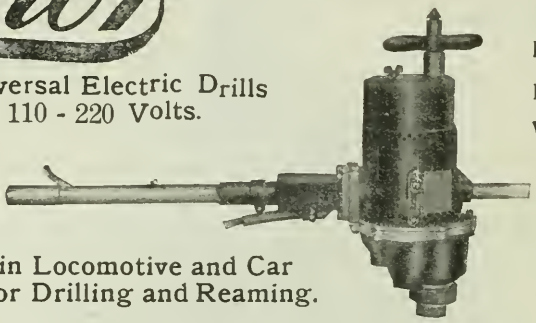

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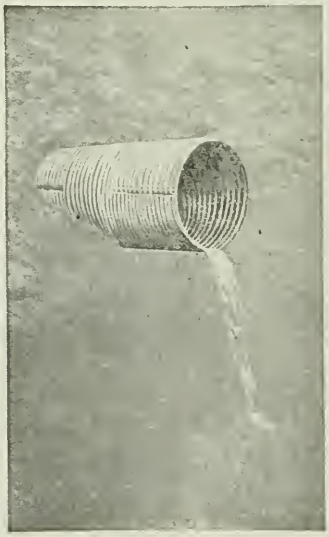

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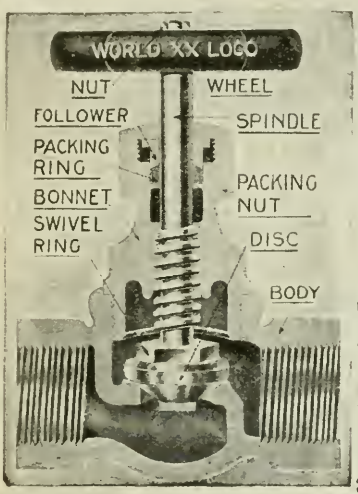

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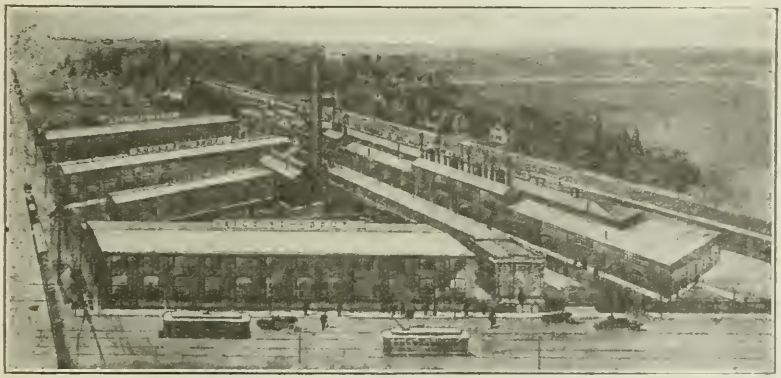

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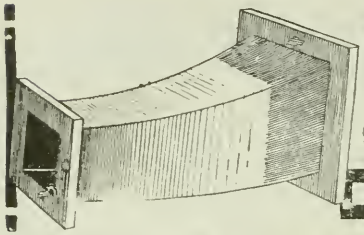

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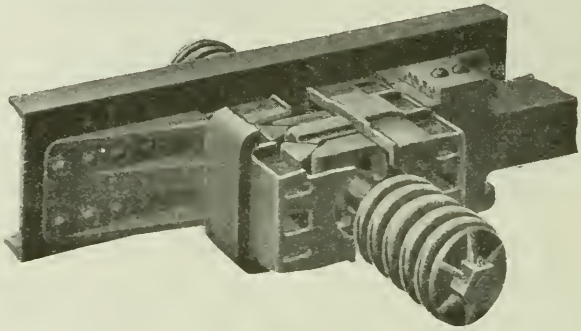

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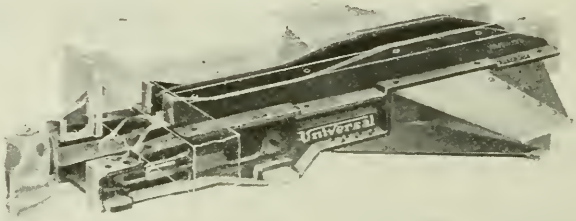

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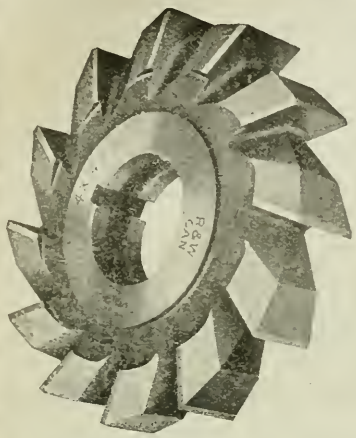

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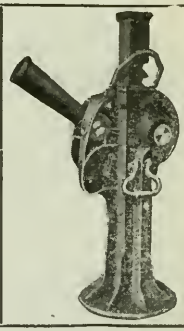

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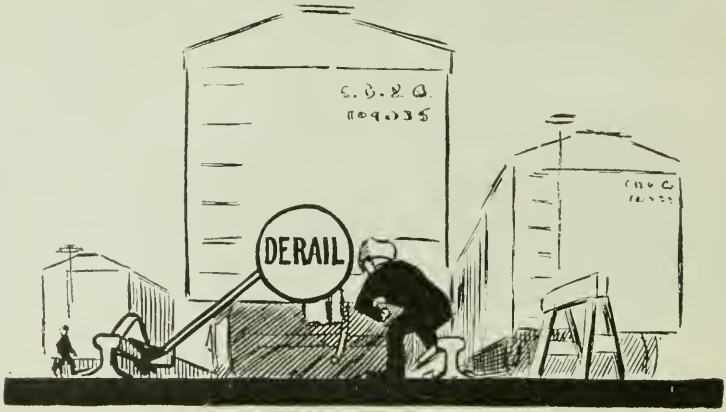

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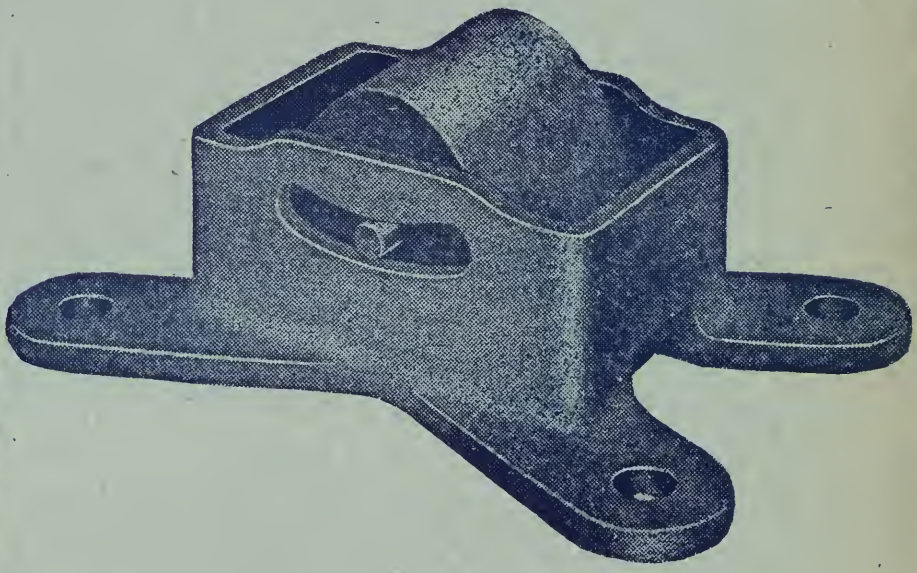

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